



SPECIFICATION

TITLE OF THE INVENTION

Wet hand towel supply apparatus

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

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The present invention relates to a wet hand towel supply apparatus and in particular, to a wet hand towel supply apparatus for producing and supplying a wet hand towel wound-up into a roll.

DESCRIPTION OF THE RELATED ARTS

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In recent years, a small sized wet hand towel supply apparatus has been developed, which produces and then supplies a wet hand towel wound-up into a roll. For example, the Japanese Patent No. 3302662 has disclosed "a rolled-up wet hand towel supply apparatus".

In the conventional wet hand towel supply apparatus, a sheet of hand towel material is cut into individual pieces of hand towel during its being transferred from a container section to an ejection port. The single piece of hand towel after having been cut is processed to contain moisture, then wound up into a roll and ejected from the ejection port.

Specifically, when the hand towel material is introduced into a clearance between a roller and a belt, a leading edge of the hand towel material comes into contact with a concave-convex portion and starts to be wound up into a roll. Subsequently, during the hand towel material is passing through a winding-up clearance, the hand towel material passes through the clearance between a conveyor belt curved along a winding

roller and a hand towel fabricating guide member. The hand towel material is further wound up to increase its diameter. As a result, a limit switch is turned on to stop a transfer means and thus stop feeding of the hand towel material into the hand towel fabricating passage.

During the above operation, the rotation of the conveyer belt is still carried on. Due to this, the hand towel material is pulled toward the downstream exclusively in its heading portion with its intermediate portion fixedly secured, so that the hand towel material defining a single piece of hand towel is cut off along a perforated line in its leading side. A piece of hand towel after having been cut off is fully wound up and ejected as a single rolled-up hand towel.

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The hand towel fabricating guide member in the hand towel supply apparatus according to the prior art, however, is provided with a plenty of small concave-convex portions formed across an entire surface thereof facing to a passage of the hand towel material. This causes sometimes too early winding-up motion of the hand towel material and thereby incorrect cutting location shifted from a predetermined perforated line toward a feed side of the hand towel material, resulting in a failure in cutting operation of correct length for one piece of hand towel.

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An object of the present invention is to provide a wet hand towel supply apparatus which can always cut off a single piece of hand towel material exactly at its cutting location smoothly.

Another object of the present invention is to provide a wet hand towel supply apparatus which can enhance a durability of a hand towel fabricating guide member.

Still another object of the present invention is to provide a wet hand towel supply apparatus which can start a winding-up operation from a leading edge of a hand towel material exactly and smoothly.

SUMMARY OF THE INVENTION

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A first invention provides a wet hand towel supply apparatus comprising: a housing having a stock container for accommodating a stock of long sheet of hand towel material and an ejection port for ejecting a piece of hand towel fabricated from said hand towel material; a transfer means housed in said housing and activated by a driving source to transfer the hand towel material from said stock container to said ejection port; a cutting means for cutting the hand towel material during being transferred into pieces of hand towel material, each having a size defining one piece of hand towel; a moistening means for causing the hand towel material during being transferred or the hand towel after having been cut into a piece to contain moisture; and a winding-up means for winding up the hand towel after having been moistened into a roll, in which said winding-up means comprises: a belt conveyor including a conveyor belt bridging across between a winding roller used for winding up the hand towel and a driven roller; and a hand towel fabricating guide member, which extends along an outer side of said conveyor belt over a region thereof extending from a front belt portion via a winding portion winding around the winding roller to a back belt portion for defining a hand towel fabricating passage between said guide member and said conveyor belt, wherein a winding-up initiating protrusion is formed on a surface of said hand towel guide member facing to said hand towel fabricating passage exclusively in a portion thereof facing to an end portion of said front belt portion in said winding roller side so that a leading edge of the hand towel material which has been introduced into said hand towel passage comes in contact with said protrusion thereby initiating a winding-up of said leading edge into a roll.

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The material, size and shape of the housing may not be limited.

The hand towel material may include, for example, clothing such as woven fabric, non-woven fabric and knitted fabric, and additionally paper. The point is that any materials may be employed so far as they, if appropriately added with moisture, can be used as a wet hand towel.

The sheet or strip shaped hand towel material to be accommodated in the stock container may be a sheet material that has been wound-up in a roll or may be a sheet material that has been folded in a zigzag manner.

The hand towel material may include perforated lines provided for each predetermined length to facilitate the cutting into each single piece of hand towel. The configuration of the perforated line may not be limited. The perforated line may be a straight line, a polygonal line or a curved line of desired shape.

The type of driving source may not be limited. In one example, an electric motor may be employed.

A printing means may be arranged within the housing, so that it can print a design including, for example, a name of a store or a pattern, on the hand towel material or each independent cut-off hand towel.

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The system for transferring the hand towel material is not limited, but may be such a roller system by way of example in which the edge of the hand towel material is clamped between a pair of oppositely positioned rollers, so that the hand towel material may be transferred by rotating the roller(s) by a driving source.

The method for moistening is also not limited, but may be the blowing by a spray or may be the application with a brush. Furthermore, the hand towel material or a single piece of hand towel after the cutting may be dipped in water. Any excessive moisture content (liquid component) may be squeezed off by introducing the hand towel (material)

to pass through between squeeze rollers.

The water referred herein includes not only simply a water but also broadly an aqueous solution composed of the water added with an aromatic substance, a bactericidal substance, a sterilizing agent, an antibacterial agent, a detergent or other additives. Further, the hand towel supply apparatus may be loaded with a cold water means so as to enable a cold hand towel to be supplied. Alternatively, the hand towel supply apparatus may be loaded with a hot water means allowing for a hot hand towel to be supplied.

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The hand towel material in a course of transferring or the hand towel after having been cut may be allowed to contain a bacteria eradicating solution. The type of the bacteria eradicating solution may not be limited. For example, a variety of alcohol may be used.

The water to be supplied by the moistening means to the hand towel material or the single piece of hand towel after having been cut may be mixed with the bacteria eradicating solution (e.g., alcohol). Alternatively, the hand towel material or the single piece of hand towel after having been cut may be directly supplied with the bacteria eradicating solution separately from those of the moistening means.

The supply system of the bacteria eradicating solution to the hand towel material or the single piece of hand towel may not be limited. In one example, the blowing by a spray, the application with a brush and the like may be employed. Furthermore, the hand towel material or the single piece of hand towel may be dipped in the water. In that case, the bacteria eradicating effect includes also the one having only the antibacterial activity.

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The method of winding-up of the hand towel may not be limited. For example, it may employ the winding-up by using a winding roller

or another method in which a winding-up conveyor is rotated in the inverse direction to the transferring direction of the hand towel to thereby wind up the hand towel.

Furthermore, the fabricated hand towel may be wrapped with a plastic film or the like. In that case, a wrapping means should be added to the apparatus.

Further, a display section such as a liquid crystal display may be installed in an exposed surface of the housing so as to provide an image display of the hand towel or the like. Further, if the liquid crystal display is of a touch-panel system, then a number of hand towel units to be supplied may be entered or the fabrication of hand towel may be initiated by touching the screen.

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The hand towel fabricating passage comprises an introducing clearance of the hand towel material, which defines an upstream section, a winding clearance for winding-up the hand towel material, which defines an intermediate section, and an ejecting clearance for ejecting the wound-up hand towel, which defines a downstream section.

The hand towel fabricating guide member may comprise a portion facing to the front belt portion, a portion facing to the winding portion of the conveyor belt winding around the winding roller and a portion facing to a back belt portion, all formed integrally into one unit. Alternatively, the hand towel guide member may be composed of those three portions that have been fabricated from independent members and then coupled to each other via predetermined connecting structures. Among those, the portion facing to the winding portion of the conveyor belt winding around the winding roller may be operatively configured so as to be movable or expandable in the longitudinal direction of the belt conveyor. Alternatively, it may be configured not to move or expand.

The material, shape and height of a protrusion of the winding-up

initiating protrusion may not be limited. As for the material, a rubber or a soft synthetic resin may be employed so that a frictional resistance against the leading edge of the hand towel material may be increased.

The number of protrusions to be formed in the winding-up initiating protrusion may not be limited. In one example, two or three rows of protrusions (5 to 20 protrusions in each row) may be arranged along the transferring direction of the hand towel material.

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A second invention provides a wet hand towel supply apparatus in accordance with the first invention, in which said portion of the hand towel fabricating guide member facing to said winding portion of the conveyer belt winding around the winding roller is a stationary belt made of elastic material.

The elastic material may employ, for example, a rubber or a variety of soft synthetic resins or a variety of expandable synthetic resins.

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A third invention provides a wet hand towel supply apparatus in accordance with the first invention, in which said portion of the hand towel fabricating guide member facing to said winding portion of said conveyer belt winding around the winding roller is made up of a moving cover plate for winding the hand towel, which is capable of moving in the longitudinal direction of said belt conveyor, and said hand towel fabricating guide member is provided with a spring member that always biases said moving cover plate toward the winding roller.

The moving cover plate is a rigid plate. The material for making the moving cover plate may employ, for example, a variety of hard synthetic resins and a variety of metals.

The spring member may employ a variety of springs including a coil spring. In addition, a variety of synthetic resins having elasticity, including a sponge, may be employed.

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Each of a fourth, a fifth and a sixth inventions provides a wet hand towel supply apparatus in accordance with either one of the first through the third inventions, in which said winding-up initiating protrusion is composed of a plurality of rows of protrusions arranged in the transferring direction of the hand towel material, said rows of protrusions getting higher toward the downstream.

The number of rows of the protrusion of the winding-up initiating protrusion may not be limited. For example, two or three rows of protrusions may be used.

The difference in height between any adjacent rows of protrusions of the winding-up initiating protrusion may not be limited. For example, the difference in a range of 0.5 to 5 mm may be employed.

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According to the present invention, the hand towel material is transferred from the stock container to the ejection port by the transfer means. During being transferred, the hand towel material is cut into a single piece of hand towel by the cutting means. In addition, the hand towel material or the single piece of hand towel after having been cut may be processed to contain moisture by the moistening means. After that, the hand towel is wound up into a roll by the winding-up means, and thus fabricated hand towel is ejected from the ejection port.

Especially, in the operation for winding up the hand towel by the winding-up means, the hand towel material, driven by the rotation of the conveyor belt, is introduced into an inlet side of the hand towel fabricating passage from outside, and when the hand towel material reaches the specific portion in said hand towel fabricating passage facing to the end portion of the front belt portion in the winding roller side, the leading edge of the hand towel material comes into contact with the winding-up initiating protrusion providing the high frictional

resistance. Owing to this, the winding-up operation can be started from the leading edge of the hand towel material into a roll. As a result, the starting of this winding up operation of the hand towel material will occur at later timing as compared with the case by the conventional apparatus in which the concave-convex portion is formed on a surface of the member facing to the hand towel fabricating passage across an entire surface thereof extending from the middle-stream section to the downstream section facing to the front belt portion. Consequently, the predetermined cutting position of the hand towel material can be set always on the location in which the perforated line has been formed or on the location shifted a little therefrom toward the leading edge thereof. This allows the hand towel material having a length for one piece of hand towel to be always cut off in its correct cutting position smoothly.

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According to the third invention, while the hand towel material that has just started to be wound-up is passing through the region in the hand towel fabricating passage facing to the winding portion of the conveyer belt winding around the winding roller, in association with an increasing diameter of the hand towel material due to the winding-up motion thereof, the entire moving cover plate is pushed out toward a peripheral direction resisting against the spring force of the spring member.

Thus, since the portion of the hand towel fabricating guide member facing to the winding portion of the conveyer belt winding around the winding roller is not made up of stationary belt having the elasticity but of rigid moving cover plate, therefore the durability of the hand towel fabricating guide member can be improved.

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Further, according to each of the fourth through the sixth

inventions, since the winding-up initiating protrusion has been composed of a plurality of rows of protrusions arranged in the transferring direction of the hand towel material such that said rows of the protrusions may be getting higher toward the downstream, therefore the winding-up operation of the hand towel material can be started from the leading edge thereof exactly and smoothly.

BRIEF DESCRIPTION OF THE DRAWINGS

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Fig. 1 is an enlarged side elevational view of a winding mechanism used in a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 2 is a perspective view of a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 3 is a longitudinal sectional view of a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 4 is an enlarged perspective view showing a hand towel material used in a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 5 is an enlarged side elevational view of main components of a sheet material feeding section used in a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 6 is an enlarged perspective view of main components of a sheet material feeding section used in a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 7 is another enlarged perspective view of main components of a sheet material feeding section used in a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 8 is an enlarged perspective view of a hand towel fabricating guide member of a winding mechanism used in a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 9 is an enlarged side elevational view of a belt conveyor portion of a winding mechanism used in a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 10 is a front elevational view of a winding roller in a winding mechanism used in a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 11 is an end view taken along the line B-B of Fig. 10;

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Fig. 12 is a block diagram showing a control circuit of a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 13 is a schematic side elevational view showing a state immediate after the starting of the supply of a sheet material in a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 14 is a schematic side elevational view showing a state of the starting of the winding operation of a sheet material in a wet hand

towel supply apparatus according to one embodiment of the present invention;

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Fig. 15 is a schematic side elevational view showing a state where a wound-up portion of a sheet material has run onto a winding roller in a wet hand towel supply apparatus according to one embodiment of the present invention;

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Fig. 16 is a schematic side elevational view showing a state of cutting-off of a sheet material in a wet hand towel supply apparatus according to one embodiment of the present invention; and

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Fig. 17 is a schematic side elevational view showing a state immediate before the ejection of a wound-up hand towel in a wet hand towel supply apparatus according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

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Preferred embodiments of the present invention will now be described with reference to the attached drawings. For the convenience in understanding the invention, the left side in Fig. 2 and Fig. 3 is defined as a forward (front) side of an apparatus.

In Fig. 2 and Fig. 3, a wet hand towel supply apparatus according to one embodiment of the present invention is generally represented by symbol "A", which comprises a main body defined as a housing 1 of substantially rectangular parallelepiped shape having openings in a front face and a top face thereof respectively. Within an upper portion in a front side of the housing 1, a stock container 1a for accommodating a roll 2 which has been made by winding-up a sheet material (hand towel

material) 2a into a roll is defined by a partition wall 3 assuming a substantially circular arc. The roll 2 is detachably installed in said stock container 1a. A front lid 1b operative to open and close the opening in the front face is pivotally supported at a lower front portion of the housing 1. A central region of the front face of the front lid 1b has a logo display section 1h which indicates a logo of a store that has purchased this apparatus. An ejection port 1c, from which the hand towel is to be ejected, is formed in a lower portion of the front lid 1b. A receiving tray 10 serving for openably closing said ejection port 1c and for receiving an ejected hand towel is pivotally supported at a lower portion of the front lid 1b. Disposed in an upper portion of the front lid 1b are an one-sheet switch 1d allowing for only one piece of hand towel to be ejected, a five-sheet switch 1e allowing for five pieces of hand towel to be ejected and a suspending switch to suspend the production operation of the hand towel.

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Further, an upper lid 1g is pivotally supported in an upper side portion of the housing 1, which serves for opening and closing the opening defined in the upper side of the housing 1. A main switch 13 and a water-boiler switch 14 are disposed in parallel in a substantially central region in one of the side faces of the housing 1.

The sheet material 2a may be by way of example a non-woven fabric made of rayon by 100% having a thickness range of 0.35 to 0.4 mm. In the sheet material 2a, perforated lines 2a are formed to define each one piece of hand towel (Fig. 4). Further, a name (logo) of the store, that has purchased this apparatus, or the like may be printed on the sheet material 2a. A sheet material supply section (transfer means) 4 for feeding the sheet material 2a that is to be wound out of the roll 2 is disposed in a front lower end of the partition wall 3 provided so as to follow the circumference of the roll 2. Further, a winding

mechanism section (winding-up means) 5 serving for winding the sheet material 2a that has been fed from the sheet material supply section 4 is disposed beneath said sheet supply section 4. Said winding mechanism section 5 is also serving as a cutting means for cutting the sheet material 2a during being transferred into each single piece having a size for a single piece of hand towel.

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A water tank 6 is detachably mounted in an upper rear portion within the housing 1. The water tank 6 is configured such that it can supply the water through a bottom portion thereof that is opened by mounting the tank in its place. Further, a water boiler 7 and a pump 8 are installed beneath the water tank 6. On one hand, a nozzle 9 is disposed above the winding mechanism section 5. The water in the water tank 6 is supplied to the nozzle 9 via the water boiler 7 by the pump 8. It is to be noted that a liquid agent such as an alcohol that has a bacteria eradicating or bactericidal effect may be supplied alone or in combination with the water through the nozzle. An alcohol tank may be installed separately or alternatively a mixed solution may be injected into the water tank.

The water boiler 7 may be activated as desired by manipulating the water-boiler switch 14. The supply of the water (or the hot water) may actuate the nozzle 9 to spray the water, thereby moistening the sheet material 2a to be pulled into the winding mechanism section 5. Specifically, above-described water tank 6, water boiler 7, pump 8 and nozzle 9 altogether construct a moistening means causing the sheet material 2a to contain the moisture. The hand towel that has been produced by the winding mechanism section 5 is ejected onto the receiving tray 10. Further, a water drip pan 11 disposed in a lower front portion of the housing 1 collects drops of water dripping from the winding mechanism section 5 and drains them into the receiving tray 10.

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Then, the sheet material supply section 4 and the winding mechanism section 5 will be described in detail.

As shown in Figs. 5 through 7, the sheet material supply section 4 has a motor section 41, a supply roller section 42 and a driven roller section 43.

The motor section 41 comprises a motor (driving source) 401 and a gear 402 that can be rotationally driven clockwise by said motor 41. On the other hand, the supply roller section 42 comprises a supply guide 403, a supply roller 404 rotatably supported by a fixing portion (not shown) in the housing 1 side such that a part of the circumference of the supply roller 404 may protrude over the supply guide 403, and a gear 405 installed coaxially with said supply roller 404. This gear 405 is engaged with the gear 402 to allow the power to be transmitted therethrough.

The supply roller 404 is a roll member comprising major diameter portions 404a whose circumferential surfaces are made of rubber having a high frictional resistance and minor diameter portions, though not shown, which are alternately disposed in the axial direction with a part of the circumference of each major diameter portion 404a protruding over the supply guide 403 (Fig. 6). On the other hand, the lower end portions 403a of the supply guide 403 are overhanging downward beyond the supply roller 404 and are aligned in comb tooth configuration, as inclined so as to be rather close to the driven roller section 43 as shown in Fig. 5. Those lower end portions 403a have an effect to prevent the sheet material 2a to wind around the supply roller 404 and also another effect to feed the sheet material 2a in a certain direction.

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Further, the driven roller section 43 comprises a front guide 406 capable of swinging around a pin 409 as a center, a driven roller 407 rotatably supported on said front guide 406, and a spring 408 attached

to the front guide 406. The spring 408 is engaged with the housing 1 in its left end and engaged with the front guide 406 in its other end. With this spring 408, the front guide 406 is biased clockwise around the pin 409 as the center. This provides a predetermined force to press the driven roller 407 against the supply roller 404. A top end portion 406a of the front guide 406 is curved toward the left in Fig. 5. If the top end portion 406a is pushed to resist against the spring 408 and thereby to make a clearance between said two rollers (404, 407), the leading edge of the sheet material 2a that has been wound off from the roll 2 can be introduced into the clearance. The driven roller 407 is made of rubber or plastic material, which is harder than the supply roller 404 in order to stabilize a feeding direction of the sheet material 2a.

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Said winding mechanism section 5 includes a motor section 51 and a winding mechanism 52, as shown in Figs. 1, 3 and 8 through 11. The motor section 51 comprises a motor 501 and a gear 502 which is rotationally driven counterclockwise by said motor 501.

On the other hand, the winding mechanism 52 comprises a winding roller 503 having disk-like flanges 503a formed in both ends in its axial direction, a gear 504 disposed coaxially with the winding roller 503, a driven roller 505 having disk-like flanges 505a formed in both ends in its axial direction, a conveyor belt stretching across between the winding roller 503 and the driven roller 505, and a hand towel fabricating guide member 53 which extends along an outer side of the conveyor belt over a region thereof extending from a front belt portion via a winding portion winding around the winding roller 503 to a back belt portion for defining a hand towel fabricating passage "a" between said guide member 53 and the conveyor belt 506. Among those components, the winding roller 503, the driven roller 505 and the conveyor belt

506 altogether construct a belt conveyor to be used for winding up the sheet material 2a.

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The hand towel fabricating passage "a" is composed of an upstream section (the region facing to the front belt portion) having an introducing clearance for receiving the sheet material 2a, a middle-stream section (the region facing to the winding portion of the conveyor belt winding around the winding roller 503) having a winding-up clearance for winding-up the sheet material 2a, and a downstream section (the region facing to the back belt portion) having an ejecting clearance for the fully wound-up hand towel. The introducing clearance is getting narrower gradually toward the downstream, the winding-up clearance has very little clearance formed in the region facing to the winding portion of the conveyor belt winding around the winding roller 503, and the ejecting clearance is getting wider gradually toward the downstream.

The hand towel fabricating guide member 53 comprises an upper guide plate 508 defining a region facing to the front belt portion, a moving cover plate 507 having a fallen J-shape in side elevational view and defining a region facing to the winding portion of the conveyor belt winding around the winding roller 503, and a lower guide plate 509 defining a region facing to the back belt portion. The moving cover plate 507 is made of hard synthetic resin and extended to the vicinity of the middle portion of the back belt in its longitudinal direction.

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The upper guide plate 508 is made of hard synthetic resin and its edge in the introduction port side is curved upward for facilitate the easy introduction of the sheet material 2a into the hand towel fabricating passage "a". A plurality of injection ports 508a for spraying the water from the nozzle 9 over the sheet material 2a is formed in an upstream section of the upper guide plate 508. A large number of connecting

pins 508b is integrally formed in an upper surface of the upper guide plate 508 in its downstream section, which are to be loosely inserted into a corresponding large number of elongated holes 507a formed in an upstream section of said moving cover plate 507. Those elongated holes 507a have been made longer in the transfer direction of the sheet material 2a. Those elongated holes 507a and the connecting pins 508b are formed to define a specified pitch between adjacent ones in the width direction of the hand towel fabricating guide member 53.

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Further, a lining plate 511 made of soft synthetic resin is affixed to an under surface of the upper guide plate 508 (the surface facing to the hand towel fabricating passage "a"). A plurality of sheet guiding ridges 511a having low-profile is integrally formed on the under surface of the lining plate 511 over its upstream to middle-stream region, which are spaced equally by predetermined intervals across a plate width direction thereof so as to reduce a contact area with the sheet material 2a thereby to facilitate a smooth moving of the sheet material 2a. In addition, a winding-up initiating protrusion 511b is integrally formed on the under surface of the lining plate 511 in the vicinity of the downstream thereof, which is to come into contact with the leading edge of the sheet material 2a that has been introduced into the hand towel fabricating passage "a" and serve to increase the frictional resistance against the sheet material 2a to initiate the winding-up operation of the leading edge of the sheet material 2a into a roll (Figs. 1 and 8). The winding-up protrusion 511b is composed of three rows of protrusions (17 protrusions in each row) arranged to be perpendicular to the transfer direction of the sheet material 2a, and the protrusions in the second and third rows are made higher by 2 to 3 mm than those in the first row. To add to that, a rubber strip 511c is affixed to the under surface of the lining plate 511 in the downstream thereof across the full width

of the plate.

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A downstream end of the moving cover plate 507 is bent downward at approximately 90 degrees to form a bent section 507b. A pair of small dome-shaped pin covers 507c is integrally formed in the bent section 507b on its surface in the winding roller 503 side and on its both ends in the width direction of the hand towel fabricating guide member 53, respectively. In the bent section 507b, a pair of pin holes is formed in the regions surrounded by the pair of pin covers 507c, respectively. A bent section 509a is formed also in an upstream end of the lower guide plate 509 and pin holes are formed therein in locations corresponding to those of the pin holes in the bent section 507b. A set of pin 513 and a coil spring or a spring member 512 is inserted into each of said pin covers 507a with a shaft of said pin 513 loosely inserted into the spring member 512. The shaft of each pin 513 is inserted through the pin hole of the bent 507b and engaged by thread with the pin hole of the bent 509a. The moving cover plate 507 is adapted to move a little along the longitudinal direction of the conveyor belt 506 with the aid of the connecting structure in the upstream side allowing for the sliding movement via the elongated holes 507a and the connecting pins 508b as well as the spring type connecting structure via the spring members 512 and the pins 513. The spring members 512 always press the moving cover plate 507 against the winding roller 503.

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A rubber sheet 514 is affixed to the surface of the upstream side portion of the moving cover plate 507 facing to the hand towel fabricating passage "a" to increase the frictional resistance against the sheet material 2a. A series of small ridges 514a having low profile is integrally formed on the surface of the rubber sheet 514 facing to the hand towel fabricating passage "a" with a predetermined pitch in the

transfer direction of the sheet material 2a. The longitudinal direction of the small ridge 514 corresponds to the width direction of the hand towel fabricating guide member 53 (the direction perpendicular to the transfer direction of the sheet material 2a). Further, a series of small ridges 514b, which is made of synthetic resin with the same size and the same pitch as the small ridges 514a, is integrally formed on the surface of the moving cover plate 507 facing to the hand towel fabricating passage "a" located in the downstream side portion thereof in the region facing to the winding portion of the conveyer belt winding around the winding roller. Those small ridges 514b do not have as high frictional resistance as the rubber small ridges 514a but work effectively to facilitate the smooth transfer of the hand towel toward the ejecting clearance, while further winding-up the hand towel approaching to the ending of the winding-up operation.

The lower guide plate 509 is a thin plate made of hard synthetic resin with its end portion in the downstream side curved downward for facilitating the easy ejection of the rolled-up hand towel.

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Said gear 504 is engaged with the gear 502 of the motor section 51 so as to receive the power transmitted therefrom. A limit switch 510 is disposed along the outer surface of the moving cover plate 507.

The conveyor belt 506 includes protrusions 506a formed by a predetermined interval on the outer surface thereof to serve for increasing the frictional force (Fig. 9). In addition, a series of concave-convex portions 506b are formed on the inner surface of the conveyor belt 506. Concave-convex portions 503b are also formed on the surface of the winding roller 503, over which the belt is stretched, (Figs. 10 and 11). Those concave-convex portions 503b are engaged with the concave-convex portions 506b on the inner surface of the conveyor belt 506 to ensure the power to be transmitted from the winding roller

503 to the conveyor belt 506. This would allow a constant tension to be always applied to the conveyor belt 506.

0046

Then, a control circuit of the wet hand towel supply apparatus "A" will be described with reference to the block diagram of Fig. 12. A control section 15 fixedly attached to an inner surface of a side plate of the housing 1 is, in its input side, connected with the one-sheet switch 1d, the five-sheet switch 1e, the suspending switch 1f, the main switch 13, the water-boiler switch 14, and the limit switch 510. The limit switch 510 detects a movement of the moving cover plate 507 in association with the hand towel passing through the winding-up clearance. A variety types of sensor may be used instead of the limit switch 510. On the other hand, the output side of the control section 15 is connected with the water boiler 7, the pump 8, and the motors 401 and 501.

The control section 15 controls the water boiler 7, the pump 8 and the motors 401, 501 based on the inputs from the one-sheet switch 1d, the five-sheet switch 1e, the suspending switch 1f, the main switch 13, the water-boiler switch 14 and the limit switch 510.

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Next, an operation of the wet hand towel supply apparatus "A" will be described with reference to Figs. 1 through 17.

At first, the water tank 6 and the roll 2 are mounted and a winding end of the roll 2 is guided into and clamped between the supply roller 404 and the driven roller 407. After that, the main switch 13 is turned on. As desired, if the water-boiler switch 14 is turned on, then the water-boiler 7 will heat the water up to a predetermined temperature.

Subsequently, a user may press the one-sheet switch 1d. Alternatively, if five pieces of hand towel are desired, then the user will press the five-sheet switch 1e. This can activate the motors 401, 501 and the pump 8.

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Specifically, as shown in Fig. 13, the motor 401 drives the supply roller 404 to rotate counterclockwise and the driven roller 407 to rotate clockwise, and thereby to feed out the sheet material 2a. On the other hand, the motor 501 drives the winding roller 503 to rotate clockwise and thereby to rotate the conveyor belt 506. This causes the sheet material 2a to be pulled onto the conveyor belt 506 through the introduction port of the hand towel fabricating passage "a" and to be moistened with the water (or the hot water or the mixed solution with the alcohol) injected from the nozzle 9.

Subsequently, the sheet material 2a is conveyed on the conveyor belt 506. The sheet material 2 then comes into contact with the winding-up initiating protrusion 511b comprising three rows of protrusions formed on the under surface of the downstream portion of the upper guide plate 508, and the winding-up operation will be started, as shown in Fig. 14. At that time, the feeding-out rate of the sheet material 2a by the sheet feeding section 4 and the pulling-in rate of the sheet material 2a by the winding mechanism 5 are identical.

0049

When the leading edge of the rolled-up sheet material 2a runs onto the outer surface of the winding roller 503, the moving plate 507, that is caused by the rolled-up sheet material 2a to move outward resisting against the spring force from the spring member 512, now turns on the limit switch, as shown in Fig. 15. Upon receiving an actuation signal from the limit switch 510, the control section 15 stops the motor 401. This stops the rotation of the supply roller 404. Consequently, the sheet material 2a, under the condition of its feeding operation having been suspended, is pulled by the winding roller 503, to increase its tension. As a result, the sheet material 2a is cut in the location of the perforated line "L" as shown in Fig. 16. At that time, with

the aid of the state of the sheet material 2a having been moistened, the cutting operation can be executed easily as compared to the sheet material 2a in the dried state. During this cutting operation, the rolled-up end of the sheet material 2a runs onto the winding roller 503 and is held between the conveyor belt 506 and the moving cover plate 507.

After that, the cut-off piece of the sheet material 2a is conveyed to the downstream by the conveyor belt, while being further rolled up, and finally drops from the ejecting clearance (Fig. 17). The ejected hand towel drops through the ejection port 1c onto the receiving tray 10 (Fig. 3). The control section 15 stops the operation of the motor 501 after a predetermined time from the actuation of the limit switch 510 and thus stops the rotation of the winding roller 503. If the production of the hand towel is desired to be suspended in the course of the production, the suspending switch 1f should be pressed.

0050

As described above, since the winding-up initiating protrusion 511b has been arranged on the surface of the hand towel fabricating guide member 53 facing to the hand towel fabricating passage "a" exclusively in its portion facing to the end of the front belt portion in the winding-up roller 503 side, therefore the starting of the rolling-up operation of the sheet material can be delayed as compared with, for example, such a conventional hand towel supply apparatus in which the concave-convex portions (corresponding to the winding-up initiating protrusion 511b) are formed on the surface of the hand towel fabricating guide member over its broad extent defined to face to a region of the front belt portion extending from the middle-stream section to the downstream section thereof. Consequently, the predetermined cutting position of the sheet material 2a can be set always on the location where the perforated line "L" has been formed or a location shifted

a little therefrom toward the leading edge side of the sheet material 2a. As a result, the frequency of the error to be induced in cutting off the correct length of a single piece of hand towel can be reduced, and the hand towel material can be cut in an exact cutting position smoothly.

Further, since the portion of the hand towel fabricating guide member 53 facing to the winding portion of the conveyer belt winding around the winding roller 503 is not made up of conventional stationary belt having the elasticity but of rigid moving cover plate 507, therefore the durability of the hand towel fabricating guide member 53 can be improved. However, it is to be appreciated that the stationary belt, though not shown, can be employed instead of the moving cover plate 507.

Further, since such a configuration has been employed in which the winding-up initiating protrusion 511b is composed of three rows of protrusions arranged in the transferring direction of the hand towel material 2a such that the protrusions in the second and the third rows is higher than those in the first row, therefore the winding-up operation of the hand towel material 2a can be started from the leading edge thereof exactly and smoothly.

Further, such a configuration can be added that allows for the alcohol to be injected from the nozzle 9 onto the sheet material during being transferred. The hand towel can be added with the bacteria eradicating effect.

0051

The present invention enables the predetermined cutting position of the hand towel material to be set always on the location of the perforated line or on a location shifted a little therefrom toward the leading edge side thereof. As a result, there will be almost no more error in cutting the hand towel material to a length for one piece of

hand towel, thus achieving the cutting operation in the exact position as well as in the smooth manner.

Further, according to the third invention, the durability of the hand towel fabricating guide member can be improved.

Further, according to each of the fourth through the sixth inventions, the rolling-up operation can be started from the leading edge of the hand towel material exactly and smoothly.